

This is a low-resolution printable version of the teacher-presentation information. The original PowerPoint slides are clearer and animated to assist the teacher in delivering quality content to the students.

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Licensed users of the EST Foundations curriculum have access to:

- the original animated PowerPoint files
- accompanying handouts
- detailed homework assignments
- lesson plans including online reading and research assignments, and
- suggestions on integrating this project-based curriculum.

Topic 1 (ver 1.0) Class Startup  
**Content of this module**

- Bell Work 1.1
- Class and teacher introductions
- Basic class rules
- Bell Work 1.2
- Grading scheme
- Supplies and permission requirements
- Four skill categories
- Bell Work 1.3
- Skill categories vs. team roles overview
- Overview of Engineering, Science, and Technology
- Bell Work 1.4
- Format for assignments
- Detailed discussion of each team role
- Assigning skills and team roles to students

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## 1.1 Introductions

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### Bell Work 1.1

(Read the following. Write 30 word paragraph discussing where you have practically used anything that you've learned in school.)

- *"We have ignored the lessons we might learn from sports. We pronounce science a fantastic game—that all should learn to play it. We spend years teaching background material, laws, rules, classification schemes, and verifications (disciplines) of the basic game. We plan activities for our students designed to develop in them specific skills that the best scientists seem to possess and use. We believe that proficiency with these skills is an important part of an education in science. It is as if we were developing conditioning exercises to train our students for the science they may actually do at a future time. Unfortunately, however, our students rarely get to play—to spend 13 years preparing for a game, but never once to play it, is too much for anyone."*
- [Robert E. Yeager quote in *Office of Technology Assessment, Elementary and Secondary Education for Science and Engineering: A Technical Memorandum*, US. Congress, December 1988]

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## Welcome to Robotics Today's Agenda



- Get to know the teacher
- Discuss class objectives
- Discuss basic class rules

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## Me...the teacher

- Important things:
- 
- 
- Interesting things:



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## Basic Class Objectives

- Learn to work in technical teams
- Learn how to tackle any challenging design problem
- Learn what it takes to create the technologies around us
- Learn what various engineers, scientists and technologists do
- Learn how engineers use math to design technology

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## This Class is Very Different

- You will work as a team, yet be responsible for your own contribution. The project is more complex and challenging than what you have experienced before.
- Time spent outside of class will far exceed the typical class because of the complexity of the project...15-20 hrs beyond normal homework over the first half of the semester.
- Each robotics team member must attend a minimum of five meetings plus three Saturday competition events. Twenty team meetings on Tues/Thurs evenings and Saturdays.

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## Important Class Information

- **Curriculum Summary**
- This class will introduce the student to the practical side of engineering, science, and technology. Students will learn the basics of technical communication and be introduced to manufacturing processes while they learn to apply scientific principles to tackle a real engineering challenge. The student will gain first-hand knowledge of the engineering process as the entire class works as a team to build a competitive remote control robot. Students will also explore real career options in engineering, science, and technology.
- The students will be given an overview of class material in the first weeks of the semester. Then they will spend six weeks exercising this new knowledge as they design and build a competitive robot. The remainder of the semester will then be spent analyzing their experience and exploring the class material in more depth.

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## Important Class Information

- **Non-Staff Mentors and Guest Teachers**
- Engineering students and professionals will participate in many of the team meetings and act as technical mentors to the team. Hopefully the students will benefit from the mentors' technical knowledge and career experience. These individuals are not school staff but have been approved by the school administration to aid in the teaching process. School staff members are responsible for conducting the class and all team meetings.

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## Important Class Information

- **Four Fundamental Class Rules**
  - Follow directions the first time they are given
  - Be equipped for class and bring all necessary items and information
  - Be mentally engaged and safety-aware during all class activities
  - Be respectful of other people and property in the class

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## Important Class Information

- **Consequences for Failure to Follow the Rules**
  - warning
  - phone call home
  - 30 minute detention and parent contact
  - 45 minute detention and parent contact
- **SEVERE INFRACTIONS** will be directly referred to the office (fighting, cursing)

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## Important Permission Forms

- Due on Friday
  - Parent signature on Syllabus
  - Permission to use tools
  - Permission for school to use photos

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## Time to Ponder

- Why is discipline especially important in this class?

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## 1.2 Student Information and Class Requirements

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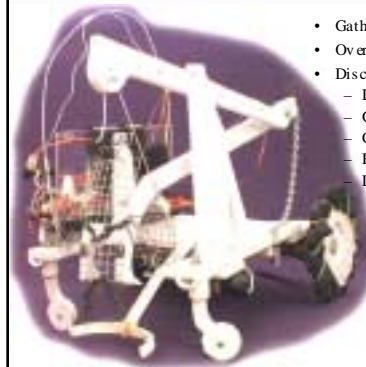
## Bell Work 1.2

(Preference Assessment)

- Quietly complete the student information form. Read through the [topics that we will cover](#) this semester. List three topics that you think will be the most interesting and explain why.
- (If you find none of the planned topics interesting, then list three engineering, science, technology related topics that you would like to cover and discuss why.)

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## Today's Agenda



- Gather information about students
- Overview the topics in this semester
- Discuss items on the Syllabus
  - Discuss basic class rules
  - Grades
  - Class supplies
  - Required commitment outside of class
  - Learn how to submit assignments

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## Items on the Syllabus (reminder)

- **Four Fundamental Class Rules**
  - Follow directions the first time they are given
  - Be equipped for class and bring all necessary items and information
  - Be mentally engaged and safety-aware during all class activities
  - Be respectful of other people and property in the class

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## Items on the Syllabus (reminder)

- **Consequences for Failure to Follow the Rules**
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- **SEVERE INFRACTIONS** will be directly referred to the office (fighting, cursing)

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## Items on the Syllabus

### Grades

- *Major grade assignments* count as 2/3 of your grade (25% tests, 25% project participation/attendance, and 16% independent research papers).
- *Minor grade assignments* count as 1/3 of your grade (20% daily work and activity journal, 14% short-quizzes and class opener activities).
- *Semester Exam* counts as 10% of the semester grade (part of 25% tests listed above).
- Short-quizzes, or **Readiness Assessment Tests**, will consist of one or two questions that assess if the student has come prepared for class, is actively keeping up with the discussion in the class, or is progressing on the weekly homework assignments. These RATs will be generally unannounced so each student should be sure to reflect on each day's class activities and seek to accomplish the declared learning objectives for each day.

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## Protocol for Submitting Assignments

- Each student has been assigned an ID number.
- At the back of the room, you'll find a slot in the cabinet with your ID number on it.
- Before you begin your bell work, you should deposit homework in the correct slot.
- Even if homework is not due, check your slot for handouts.

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## Items on the Syllabus

### Class Supplies

- Spiral bound notebook with at least 70 pages
- 1" 3-ring binder with 8-pack of dividers
- 12" straight edge for drawing (plastic ruler or drafting triangle)
- (Last name A-D) One pad of 50 sheets grid paper-8 squares per inch [shared with class]
- (Last name E-L) Two dry-erase markers-preferably fine tip [shared with class]
- (Last name M-Z) One box facial tissues or one roll paper towels [shared with class]

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## Items on the Syllabus

- The dates of the robotics competition are presently set as follows:
  - Competition Kickoff...(date, location)
  - Practice Day...(date, location)
  - Competition Game Day...(date, location)
- Attendance and participation at each of these events is mandatory. Building a robot and preparing for the competition will take a lot of team hours. In the first two six weeks, there will be many team meetings scheduled outside of normal school hours. Some meetings will require all team members but most will involve only parts of the team. **Every team member must be active in at least five of these extra meetings (20 expected meetings) in addition to the three official Competition events to receive Full attendance credit.**

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## Items on the Syllabus

- Please sign and return this page to the teacher by Wednesday, August 18<sup>th</sup>, 2005. (page 1 and 2 should be kept in the student's class notebook)...
- Make sure your parent initials by EACH one that you are allowed to use:
- **Teacher: Please modify this list according to the tools you plan to make available.**

<input type="checkbox"/> Manual Screwdrivers	<input type="checkbox"/> Manual Tap and Die	<input type="checkbox"/> Handheld Power Drill
<input type="checkbox"/> Hammers	<input type="checkbox"/> Manual PVC cutters	<input type="checkbox"/> Powered Drill Press
<input type="checkbox"/> Hand Saws	<input type="checkbox"/> Shop Clamps	<input type="checkbox"/> Powered Jig Saw
<input type="checkbox"/> Hand Scissors	<input type="checkbox"/> Pliers and Wire Cutters	<input type="checkbox"/> Powered Scroll Saw
		<input type="checkbox"/> Powered Sander

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## Items on the Syllabus

- Each student will be assigned a skill category in which they will specialize for the first part of the semester.
  - Making
  - Technical Drawing
  - Production
  - Method, Analysis, and Documentation
- Each skill is ABSOLUTELY essential if the team is to do well in the Robotics Competition.
- By the end of the semester every student will be exposed to all the skills, but there is too much material for every student to learn every skill before we have to get busy with the competition.

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## Marketing

- Though skills in this category are not generally considered "technical" in nature, these students will serve an essential role in the robotics competition. These students should:
  - acquire the skills necessary to increase program awareness in the school and the community
  - encourage the team to pursue the real purpose of the robotics program
  - compile a video and photo record of the team's progress.
- Looking for outgoing students with good planning and organizational skills.

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## Technical Drawing

- Technical communication skills are foundational in real world engineering. Without good communication, the students will not be able to work as a team and synergistic activity will be impossible. Technical drawing will take a very long time to master, but some basic concepts will take the students a long way. All students in the team should be encouraged to develop their technical sketching skills and later technical drawing skills. But, students in this specialty must acquire visualization and technical sketching skills quickly.
- Looking for students based on their pre-existing ability to visualize top/front/side views of real objects.

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## Production

- Students with this specialization will need to:
  - master tool safety
  - become fluent in basic production operations including cutting and drilling
  - interpret the technical sketches produced by other students
- Looking for students that already have experience with hands-on hobbies and are also mature enough to take safety seriously.

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## Method, Analysis, & Documentation

- These students will:
  - track the team progress through the steps of the engineering process
  - engage basic analysis of designs using electrical and mechanics principles
  - commission and compile the necessary technical documents produced by other team members into a design notebook
- Looking for students with basic algebra skills and who have good organizational skills.

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## 1.3 Skill Specialties and E. S. T. Overview

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## Bell Work 1.3

- Complete the basic information and student preference survey ([handout student questionnaire](#)).

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## Today's Agenda



- Discuss team roles and skill specialties
- Discuss the role of Engineering, Science, and Technology in society

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## Marketing (review)

- Though skills in this category are not generally considered "technical" in nature, these students will serve an essential role in the robotics competition. These students should:
  - acquire the skills necessary to increase program awareness in the school and the community
  - encourage the team to pursue the real purpose of the robotics program
  - compile a video and photo record of the team's progress.
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## Method, Analysis, & Documentation (review)

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  - track the team progress through the steps of the engineering process
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## Team Roles

**Teacher: Please modify roles to match the number of students while still covering all the responsibilities**

- In addition to an assigned skill specialty, you will have an assigned team role:

<u>Mobility Team</u>	<u>Gripper Team</u>	<u>EST Team</u>
Project Manager	Project Manager	Project Manager
Electronics Specialist	Drawing Specialist	Notebook Coord.
Drawing Specialist	Production Specialist	Presentation Coord.
Production Specialist	Analysis Specialist	Table Display Coord.
Analysis Specialist	EST Specialist	School Involv. Coord.
EST Specialist		

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## Team Roles - con't

### Support Team

- Kit Manager
- Competition Liaison
- Production/Tool Manager
- Event Manager

### Strategy Team

- Project Manager
- Game Boss
- Simulation Expert

### DSP Integration Team

- Project Manager
- DSP Programmer
- DSP Programmer

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## Time to Ponder

Today we will get an overview of Engineering, Science, and Technology. But first, how would you define each of these?

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## What is Engineering?

- ...the application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems

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## What is Engineering?

- Theodore Von Karman, an aerospace engineer, put it nicely when he said, "*Scientists discover the world that exists; engineers create the world that never was.*"

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## Engineering = Problem Solving

- As a trained problem solver, the engineering only has three basic responsibilities
  - 1) determine *all* possible solution options
  - 2) choose the *best* option, and
  - 3) implement the solution.
- Ah, if only it were that easy!
- Steps 1 and 2 are theoretically impossible but Engineering is all about applying methods to get as close as possible.

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## Many different Engineers...

- Aerospace - Design and build aircrafts
- Agricultural - Create various food production processes
- Architectural - Concerned with building issues
- Biomedical - Design medical equipment and materials
- Ceramic - Convert materials into ceramic products
- Chemical - Use chemistry to improve materials like plastics
- Civil - Design and build things (bridges) used by the public
- Computer - Design and create hardware & software
- Construction - Plan and construct buildings

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## More Engineers...

- Electrical / Electronic - Design electronics & work on producing electricity
- Engineering Management - Manage engineers and focus on research and development, operations...
- Engineering Physics - Incorporate math and physics into engineering
- Environmental - Design processes relating to environmental issues
- Geological - Work on recovering Earth's minerals
- Geotechnical - Experts on soil and the structures it will hold
- Industrial - Help organizations to operate efficiently

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## Even more Engineers...

- Manufacturing - Design manufacturing operations and products
- Marine / Ocean - Design structures for use in and around the water
- Materials - Develop new materials to improve products
- Mechanical - Design and develop all things mechanical
- Metallurgical - Focus on the processes relating to metals
- Mining - Design processes relating to mining
- Nuclear - Focus on the processes of nuclear power plants
- Petroleum - Find oil and gas and design things like oil wells
- Software - Design and create software for computers

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## What was that about Science?

- "Scientists discover the world that exists; engineers create the world that never was."
- Science is defined as the observation, identification, description, experimental investigation, and theoretical explanation of phenomena.

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## Types of Scientists?

- **Physical science** includes study of motion, sound, light, electricity, magnetism, and matter.
- **Earth science** involves the Earth (including its features), its place in the universe.
- **Life science** is the study of living things and how they interact with each other and the environment.
- **Environmental science** is concerned with the effects of human activities on the Earth's resources and inhabitants.

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## What is Technology?

- Engineering strives to design and manufacture useful devices or materials, defined as technologies, whose purpose is to increase our efficacy in the world and/or our enjoyment of it.

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## Technology vs. Engineering

- **Technology** is the application of knowledge, creativity, and resources to solve real world problems and extend human capabilities.
- **Engineering** is the application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.
- Technology is the Stuff...Engineering is the Process.

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## Where can you read more?

- <http://www.discoverengineering.org>
- <http://www.realscience.org>

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## 1.4 Class Administrative Issues

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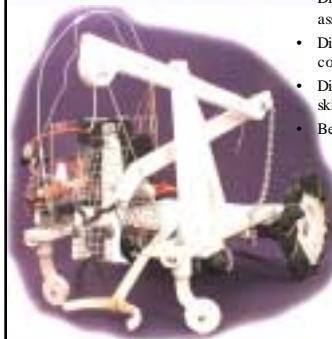
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## Bell Work 1.4

- (Always start a new journal page for each day. It is ok. for you to write on the back of the pages. Record the question or task and your response in your journal.)
- Question: Consider any consumer product (for example, golf clubs). What general types of activities must occur to transform materials into a golf club and then get a customer to buy it?

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## Today's Agenda



- Discuss format for notes and assignments
- Discuss general components of typical competition robots
- Discuss interaction of team roles and skill specialties
- Begin making skill and role assignment

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## First some administration..

- For Journal
  - First Page Header
    - Student ID
    - First-Last name
    - Robotics Class
    - Fall 2005
  - Leave second page blank
  - Start entries on third page

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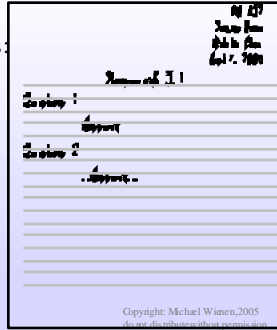
## Administration con't

- All Assignments
  - Use standard notebook sheets only
  - No tattered edges (like tearing out of spiral)
  - Use either pen or pencil (but no red ink)
  - Write only on the Front of the paper
  - Staple multiple pages in top left corner
  - Write header info on front page

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## Administration con't

- Heading on Assignments:
  - Student ID number
  - First-Last name
  - "Robotics Class"
  - Due Date



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## Administration...con't Journal Entry Example

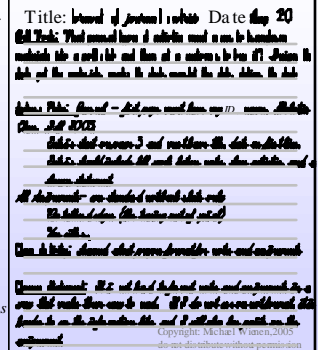
Every Journal Entry needs a title and date.

**Bell Work:** include question to bell work and write the answer here when appropriate.

**Lecture Notes:** Outline information from slides. Leave room to go back later and add information or more detail.

**Class Activity:** Describe the in-class assignment and do your work here unless you are instructed to turn it in separately.

**Closure Statement:** In one or two sentences summarize what you learned and did in class.



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## Skill Specialties vs. Team Roles

- Each student will adopt one of four skill specialties for this class:
  - Marketing
  - Technical Drawing
  - Production
  - Method, Analysis, and Documentation
- Each student will also be assigned a role on the project team.
  - See handouts for descriptions ([skill specialties](#), [team roles](#))
- Note: The composition of each subteam should combine students with different skill specialties.

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## Assigned Roles

- Teacher: Using information from student preference survey and student skill assessment, assign skill specialties and team roles, trying to balance the needs of the team and the preferences of individuals.
  - A single student can occupy multiple roles.
  - Each subteam needs a different EST specialist to document the subteam's efforts.
  - Try to create a named position for each student to increase ownership in the project.
  - Prominently post the resulting organizational chart including names and positions.
  - Allow for some shuffling of roles, but solidify the assignments as soon as possible.

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## 1.5 Gaining Perspective of the Engineering Challenge

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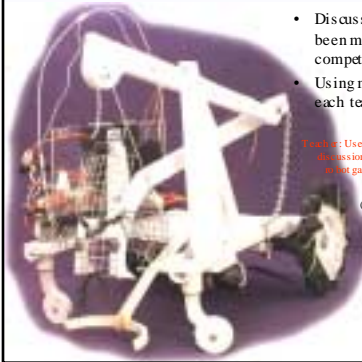
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## Bell Work 1.5

- (Always start a new journal page for each day. It is o.k. for you to write on the back of the pages. Record the question or task and your response in your journal.)
- Question: Based on what you know (or have heard) about previous robotic challenges, describe in detail what kind of "product" you'll make in this class. Include a sketch if you wish.

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## Today's Agenda



- Discuss the types of machines that have been made in previous robotics competitions.
- Using machine examples, discuss how each team role will be involved.

Teacher: Use this picture and team-role handouts to lead the discussions. Also available in the curriculum package is a photo gallery and virtual 3D model of the robot shown.

(this is the last slide in the module)

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